RECOMMENDATION TO NAESB EXECUTIVE COMMITTEE

For Quadrant:	**Retail Electric Quadrant**
Requesters:	**Smart Grid Interoperability Panel**
Request No.:	**2010 Retail Annual Plan Item 9(c)**
Request Title:	**Phase Two Requirements Specification for Common Electricity Product and Pricing Definition – for NIST PAP03**

1. RECOMMENDED ACTION:

X	Accept as requested
X	Accept as modified below
	Decline

EFFECT OF EC VOTE TO ACCEPT RECOMMENDED ACTION:

X	Change to Existing Practice
	Status Quo

2. TYPE OF DEVELOPMENT/MAINTENANCE

Per Request:		**Per Recommendation:**	
	Initiation		Initiation
X	Modification	X	Modification
	Interpretation		Interpretation
	Withdrawal		Withdrawal
X	Principle	X	Principle
X	Definition	X	Definition
X	Business Practice Standard	X	Business Practice Standard
	Document		Document
	Data Element		Data Element
	Code Value		Code Value
	X12 Implementation Guide		X12 Implementation Guide
	Business Process Documentation		Business Process Documentation

3. RECOMMENDATION

SUMMARY:

The NAESB Smart Grid Task Force (SGTF) submits this Recommendation that provides requirements for common pricing attributes that can be used as a basis for messaging protocols throughout the electrical energy system from producer through to a variety of energy consumers and the future intelligent devices employed by these consumers. These attributes are not meant to be a message protocol in and of themselves and further analysis and design work will be completed as part of several initiatives, such as ZigBee smart energy, OpenHAN, and OASIS[1] eMIX. These requirements should also be used as an input to the CIM maintained by UCAIug.

[1]Reference to the Organization for the Advancement of Structured Information Standards not the Open Access Same-Time Information System

RECOMMENDATION TO NAESB EXECUTIVE COMMITTEE

For Quadrant:	**Retail Electric Quadrant**
Requesters:	**Smart Grid Interoperability Panel**
Request No.:	**2010 Retail Annual Plan Item 9(c)**
Request Title:	**Phase Two Requirements Specification for Common Electricity Product and Pricing Definition – for NIST PAP03**

RECOMMENDED MODEL BUSINESS PRACTICES:

Executive Summary

Specifications for Common Electricity Product and Pricing Definition

The following addresses the business objectives and context for capturing the attributes associated with electricity price and product signals as part of the Smart Grid implementation, which is called for by NIST PAP 03. The use cases provide requirements for electricity price and product signal Model Business Practices.

These Model Business Practices also contains an overview of the most common retail rate structures and price-related use cases. To maintain consistency between this Model Business Practice and related Model Business Practices developed for NIST PAP 04 and PAP 09, a master list of data elements, and common sets of actors terms and definitions are being recommended.

The following deals exclusively with the pricing related requirements at both the wholesale and retail levels. The requirements are captured in the form of UML models, where business requirements are captured in use case narrative format and data requirements are captured in tabular format. The main use cases that are affected by pricing are:

- Demand Response
- Non-Price (Environmental) Response
- Load-follower
- Price-takers

Introduction

Specifications for Common Electricity Product and Pricing Definition

Purpose: The purpose of the following is to capture business and data requirements related to the definition of a common model for capturing the attributes of an electricity product offered at wholesale and/or retail level. Such attributes will mainly include but are not limited to the pricing information of the product being offered to the end consumers of electricity.

The use cases included in these Business Practice Standards are not to be required or exhaustive and are provided for clarification purposes.

Scope: The scope of the following is to provide business and data requirements, not implementation, of a common pricing model for electricity product.

The electricity rate design process is not included in the scope of these use cases.

RECOMMENDATION TO NAESB EXECUTIVE COMMITTEE

For Quadrant: Retail Electric Quadrant
Requesters: Smart Grid Interoperability Panel
Request No.: 2010 Retail Annual Plan Item 9(c)
Request Title: Phase Two Requirements Specification for Common Electricity Product and Pricing Definition – for NIST PAP03

Model Business Practices

REQ.15.1 Specifications for Common Electricity Product and Pricing Definition

REQ.15.1.1 ACTORS LIST

The actors listed in the table below are specific to this Model Business Practice and are a subset of the actors and related objects defined in REQ.0. Details on the relationships between the actors and related objects are further defined in Appendix A.

Actor Name	Actor ID[2]	Examples
Communication Method	5.5	
Control	5.2	Premise, EMS, ESI or Gateway
System Operator	2.1	Market and system operators
End Device	4.5	Electric vehicle, or smart appliance, display
Load Serving Entity	3.2	
Measurement	5.1	Meter
Premise	4.3	Electricity consumer
Resource	4.1	DER
Service Provider	3.1	Retail service provider, demand response provider, dynamic price service provider
Transmission/ Distribution Service Provider	3.5	Utility distribution company
Utility Customer	2.4	Residential, industrial

[2] The Actor ID shown in the table refers to the item number of the corresponding actor or related object in the Entity-Relationship Diagram provided in Appendix A. Definitions of the actors and related objects are included in REQ.0.

Actor Name	Actor ID[2]	Examples
Utility Distribution Operator	2.3	Distribution operator

REQ.15.1.2 USE CASE DATA CONSIDERATIONS

The following tariff rate types and product and pricing attributes were considered when developing the use cases included in this Model Business Practice.

REQ.15.1.2.1 Tariff Rate Types Considered for Use Cases

A tariff establishes the prices paid for the services received, and is based on a variety of factors including wholesale prices, quality and type of service and costs associated with transmission and distribution grid infrastructure and operation. The use cases in these Model Business Practices illustrate the high-level activities associated with publishing prices and how the information is used to evoke a change in consumption. For the use cases included below the following tariff rate types were considered:

Tariff Rate Type	Target Customers	Description
block rate	C&I, residential	An energy supply rate structure in which the per unit energy price increases or decreases for each successive block of energy consumed.
critical peak price	C&I, residential	A pricing structure in which the customer receives notification identifying a time interval, (“critical hours”) during which special higher prices apply over and above whatever other rate they may be charged. Critical hours generally represent a small percentage of the hours in the year.
demand rate	Mainly for C&I customers, pilot for residential customers	A component of an energy supply rate structure based on the highest demand for electricity measured in a billing period.
day ahead market rate	C&I, residential	An energy supply rate structure, typically hourly, based on the day-ahead wholesale market price.

Tariff Rate Type	Target Customers	Description
market clearing price for energy	C&I	An energy rate structure that allows for price changes every interval (e.g. 5 minutes, 15 minutes, hourly, etc.) based on real-time wholesale market prices.
peak time rebate	C&I, residential	An incentive rate in which the utility pays a rebate to customers who reduced demand during peak periods on critical days
real time price rate	C&I	An energy supply rate structure in which prices can vary, typically on an hourly basis, based on forecast (day-ahead) or actual (real-time) market conditions.
time of use rate	C&I, residential	An energy supply rate structure where the per unit charge (kWh or kW) varies according to the time of day. Time of use rates may have daily and seasonal variations.
variable peak pricing	C&I, residential	An energy supply rate structure that combines features of time of use and real time price structures to include the flexibility of market price variation and the fixed time periods of a time of use rate.

REQ.15.1.2.2 Product and Pricing Attributes Considered for Use Cases

For the purpose of the development of the use cases in Model Business Practice REQ.15.2, the following price and product attributes were considered.

REQ.15.1.2.2.1 Product Identification

Attribute	Description	Considerations
Product Name	An identifier for a particular electricity product offering: energy, capacity, ancillary services, etc.	Matches (Ref to Market Product in PAP 09 Wholesale)
Product Identifier	Identifies a Specific Product associated with a Price.	Any commodity benefits from having a unique identifier (external) that can unambiguously be used by consumers to identify what it is that they are purchasing. Examples of product identification scheme used in the financial world is the ISIN and stock ticker symbols used by exchanges. This not a transaction identifier – this would be an industry agreed upon identifier for a particular energy product offering.
Identifier Source (product)	Identification of the source of the Product Identifier.	In most systems there are competing or alternative product identification schemes. The Identifier Source references the product identification scheme for the Product Identifier.
Product Type	Identifies the product and market	Classifications used within industry for trading energy. Examples: PJM Energy, NYISO 10-min Spin, etc

Attribute	Description	Considerations
Product Sub-Type	The sub-type of product	Products may be further divided into subtypes, for example reserve products may be 10-minute or 30-minute response.
Source Location Identifier	The identifier of the source location of the product for which the price applies	Electric energy cost and value are greatly impacted by the distance between generation and consumption. Indicating the source of the generation is important in terms of pricing decisions on part of consumers and intermediaries. The use of source location would mainly be used for bilateral transactions.
Source Location Identifier Type	Type of location.	The mechanism used to identify location can be defined in multiple sources based upon specific usage from control areas to GPS coordinates it is anticipated that there may need to be more than one method to identify a geographical location. Where possible existing industry standards should be adopted to identify geographic locations.
Delivery Time	Time at which the product is available for physical consumption	
Delivery Interval	The duration over which the product is available for physical consumption	
Unit of Measure	Unit of measure for the identified product.	The unit of measure such as MWh or kWh. May vary between markets.

Attribute	Description	Considerations
Price Location	The location at which the price is applicable.	

REQ.15.1.2.2.2 Pricing Attributes

Attribute		Description	Considerations
Product Price		The sum of all Price Component Values for a given product (Total Price).	Price is expressed as currency per unit of measure, i.e. quantity is not required, e.g. $/MWh The sum of all Price Components must equal the Product Price.
Set of 1..n Price Components			
	Price Component Value	A component of the price.	Price may have one or more components.
	Price Component Type	The portion of the price to which the corresponding value applies	A standard set of price component types shall be enumerated, such as: • Wholesale electricity cost • Transmission costs • Distribution costs
Price Type		Time characteristic of the price	A standard set of price types will need to be defined (real time, 5 minute, day ahead, etc.)
Product Price Factor		Terms of use attribute of Product Price	Examples: Price_absolute, Price_relative, Price_multiplier
Override Unit of Measure for the Product		Alternative unit of measure applicable to a given transaction.	If this is used, then Unit of Measure is not applicable.

Attribute	Description	Considerations
Currency	Economic unit of exchange in which the total price and price components are stated (i.e. dollars, euros)	Currency is required to determine the units of measure of the Total Price and Price Components. The energy units of measure are defined by the Product Type.

REQ.15.2 Product and Pricing Use Cases

REQ.15.2.1 USE CASE OVERVIEW

The use case modeling technique is used for capturing business and data requirements relative to electric product and price information. The relationships used in the use case diagrams are as follows:

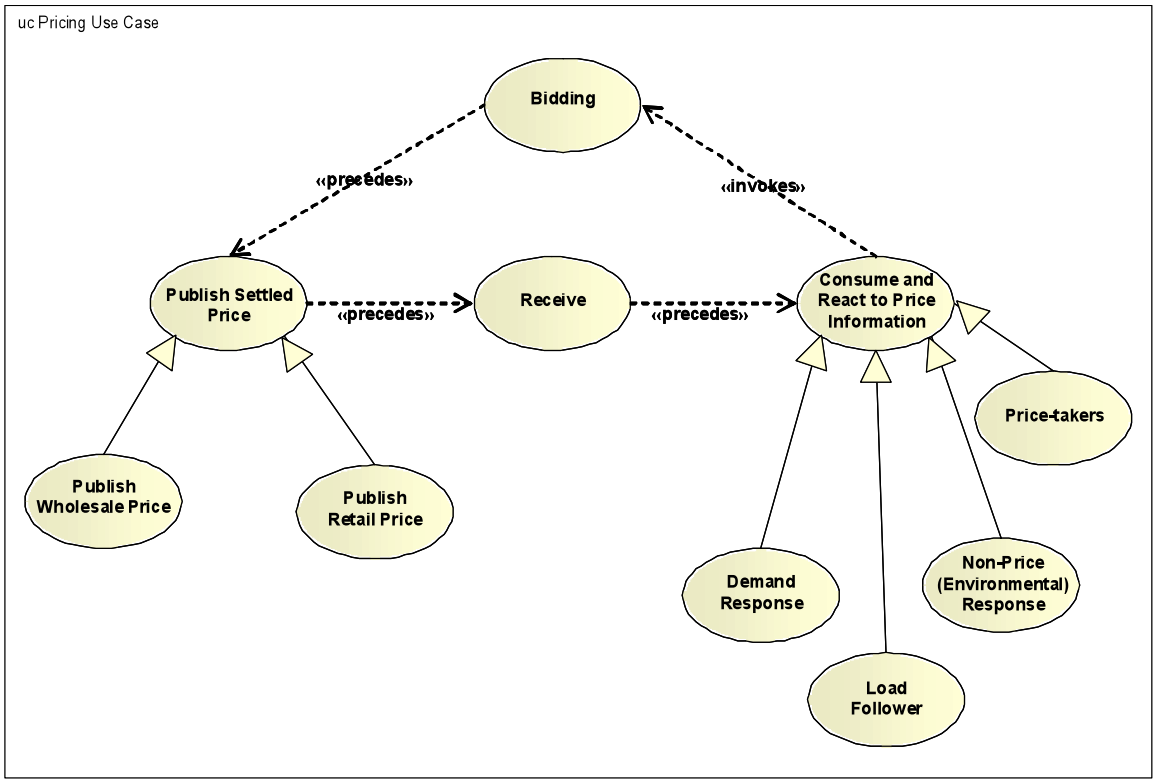
- Generalization (line with triangle head): this indicates variations (sub-types) of the main use case.
- Precedes: this indicates a time sequence
- Invokes: this indicates a pre-condition or dependency

The use cases included in these Model Business Practices are not intended to be required or exhaustive and are provided for clarification purposes.

REQ.15.2.2 PRICING USE CASE

The Pricing Use Case below provides an overview of the specific use cases described in these Model Business Practices. The results of bidding produce the settled price which is published and then received. The recipient reacts to the price, which affects the next bidding cycle. The following use cases where electricity pricing and product information can be used are described in these Model Business Practices:

- Demand response
- Non-Price (Environmental) Response
- Load-follower
- Price-takers



REQ.15.2.3 SPECIFIC USE CASES

Specific use cases for what end use consumers of electricity might do when pricing signals are received are listed as follows:

Use Case	Actors	Description	SAMPLE Scenarios
Demand Response	SP ED Control Premise	Utility Customer (or device acting under UC direction) responds to Total Price or Price Component.	The System Operator published day-ahead prices which are statistically higher than average between 2:30 and 5:30 in the afternoon. Illustrate how different End Devices will respond to a forward energy price signal including: • An EMS requests BAS to "pre-cool" until 2:30 PM. • Home-based intelligent device is programmed to operate at a time when electricity is cheaper. An electric plug-in vehicle is programmed to charge when electricity is cheaper. A utility distribution company's fixed time-of-day tariffs indicates higher price during day, and lower price after 11:00 PM. Demonstrate how different End Devices will response to price differentials: • Time-insensitive building systems schedule their run-time programs after 11:00 PM. Homeowner starts appliance at 5:10. The appliance notifies that by waiting 20 minutes to run, the consumer will get lower cost electricity. Homeowner acknowledges.
Non-Price (Environmental)	Resource ED	Product characteristics	Utility Customer sets a price threshold at which "green" power is

Use Case	Actors	Description	SAMPLE Scenarios
Response	Premise	(other than price) are used to influence either the quantity or the time at which the customer uses electricity.	desirable. Above the "green price" the customer will take any power, below the "green price" the customer will choose suppliers with renewable portfolios. Test the scenario where, at 5:00 PM wind power picks up such that the price of power from renewable sources falls below the "green price" set by the customer. Utility delivers blend of 20% wind, 80% coal during this time of day at .10/kWh. 25% of customers indicate preference to buy pure wind, an over-subscription. Prices for pure wind are bid up to .15/kWh as the wind-sensitive market decreases. 20% of consumers pay the 50% premium to get only wind-only power. 1) Local PUC requires that segmentation be revenue-neutral, so bidding for wind power reduces undifferentiated power to .0875 kWh. 2) No bidding was required for undifferentiated power, so provider is incentivized to find additional sources of wind power. 3) Consumers unable to buy desired wind power reduce their aggregate demand. Consumers have programmed non-time-sensitive systems and appliances to not run when wind power is not available, time-shifting some demand until wind power is available at the desired price.

Use Case	Actors	Description	SAMPLE Scenarios
Load-follower	DER UC		A UC is also a DER. The UC would purchase power up to the price at which the DER can economically produce power. The use case must prove that such a resource can receive enough information from the pricing signals to change its output according to the resource owner's price curve.
Price-taker	DER		A DER with no storage capability and zero fuel cost, such as a wind farm or solar array, will produce power at whatever the "market rate" for generation is at the time of production. The use case must prove that such a resource can identify its cost curve (zero in this case), supply energy to the grid, and get paid at the appropriate rate.

RECOMMENDATION TO NAESB EXECUTIVE COMMITTEE

For Quadrant:	**Retail Electric Quadrant**
Requesters:	**Smart Grid Interoperability Panel**
Request No.:	**2010 Retail Annual Plan Item 9(c)**
Request Title:	**Phase Two Requirements Specification for Common Electricity Product and Pricing Definition – for NIST PAP03**

REQ.15.A Appendix A – Entity-Relationship Model

The following terms and definitions correspond to a set of actor and objects within the overall information model for demand response. Figure 1A contains a data model used to illustrate the entity-relationships within the model.

Proper (and Improper) Usage of the Entity-Relationship Model. The entity-relationship model is used to show cardinality among objects in the model, for example every Resource belongs to one and only one Service Provider and a Premise contains one or more End Devices. The entity-relationship model does not provide use case information; actors are objects in the model and do not "act" in the model. The entity-relationship model does not imply process. For example, a Service Provider is associated with many Resources; however the enrollment of those Resources may be managed by a System Operators or a Utility Distribution Operator. Both use cases and process maps are separate components of the Model Business Practices.

Reading Crow's Foot Notation. Objects in the model which share a relationship are connected with a cardinality line. Each end of the cardinality line contains a Crow's Foot notation, as documents in the legend of the figure. The four notations utilized are "exactly-one", "one-or-more", "zero-or-one", and "zero-or-more". The cardinality line is bi-directional; meaning it can be read in two directions. For example: a Premise is related to one-or-more End Devices (reading top to bottom) and every End Device is related to exactly-one Premise (reading bottom to top).

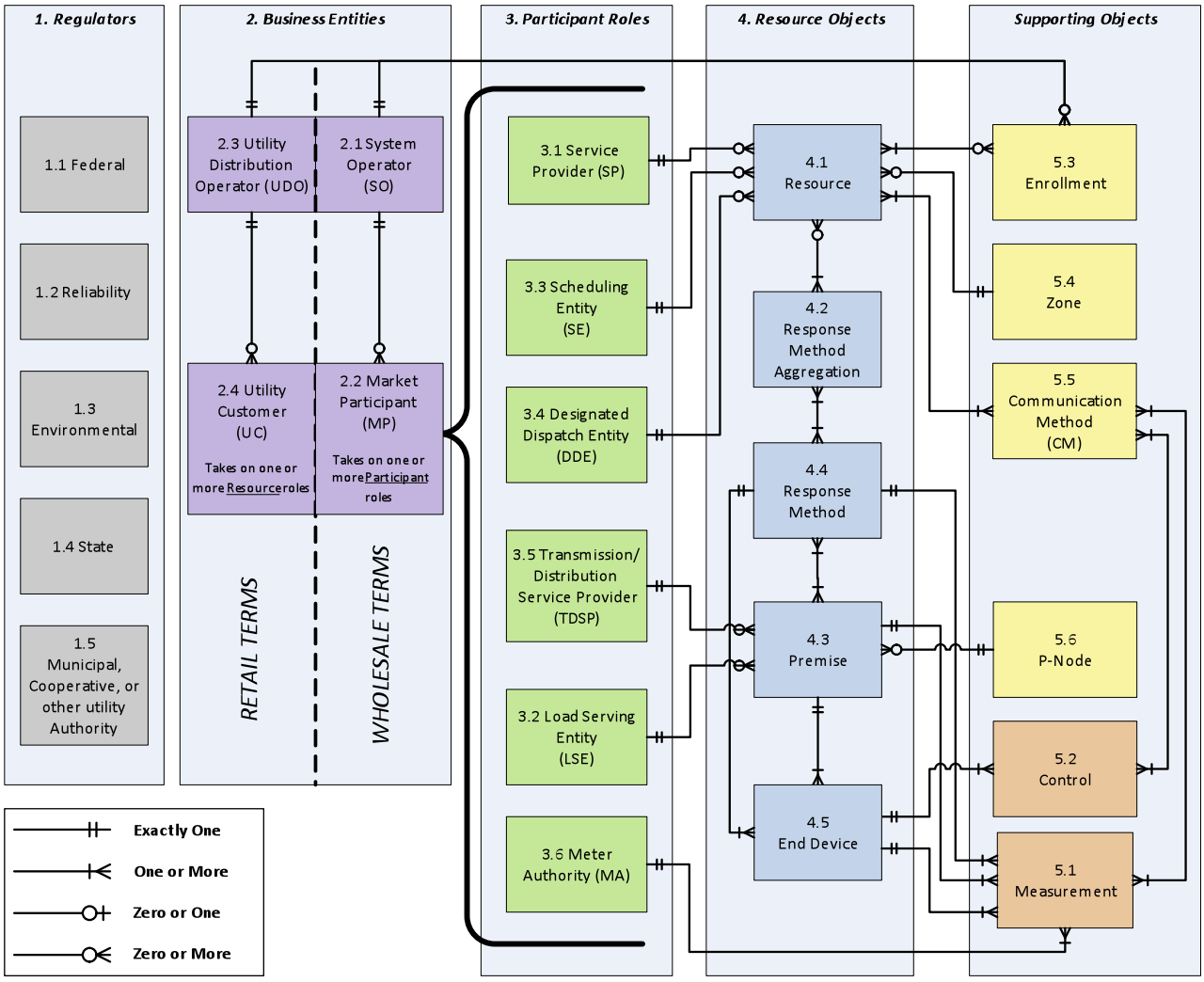
Optional Objects. The entity-relationship model is designed to support multiple business models and not every business model will require all objects to function. Therefore, all objects in the model are considered optional. For example, a Utility Distribution Operator may design a Demand Response program which requires the definition of Resources and Premises, but does not require Response Method Aggregations and Response Methods. In this example, the relationship between Resource and Premise is transitive: a Resource is comprised of one-or-more Premises and each Premise is associated with zero-or-more Resources.

Applicability to Retail and Wholesale. The entity-relationship model is applicable to both wholesale and retail. When using the model for wholesale, the applicable business entities are 2.1 (System Operator) and 2.3 (Market Participant), while in retail markets, the parallel business entities are 2.3 (Utility Distribution Operator) and 2.4 (Utility Customers). Other than the swapping of the two pairs of terms, the models are identical, including the names of and relationships among objects.

RECOMMENDATION TO NAESB EXECUTIVE COMMITTEE

For Quadrant: Retail Electric Quadrant
Requesters: Smart Grid Interoperability Panel
Request No.: 2010 Retail Annual Plan Item 9(c)
Request Title: Phase Two Requirements Specification for Common Electricity Product and Pricing Definition – for NIST PAP03

Figure 1A. Entity-Relationship Model for Smart Grid Use Cases



RECOMMENDATION TO NAESB EXECUTIVE COMMITTEE

For Quadrant:	**Retail Electric Quadrant**
Requesters:	**Smart Grid Interoperability Panel**
Request No.:	**2010 Retail Annual Plan Item 9(c)**
Request Title:	**Phase Two Requirements Specification for Common Electricity Product and Pricing Definition – for NIST PAP03**

4. Supporting Documentation

a. Description of Request:

REQ Annual Plan Item 9(a) – "Develop Requirements and Use Cases for PAP 03 – Pricing Model"

b. Description of Recommendation:

This recommendation provides the data requirements related to the use cases developed as part of the phase one effort

c. Business Purpose:

This recommendation has been developed in response to a request from NIST to provide use cases and requirements germane to the development of common specification for electric price and production definition.

d. Commentary/Rationale of Subcommittee(s)/Task Force(s):

NAESB Smart Grid Standards Subcommittee Meeting Notes/Documents:

- June 10, 2010 Meeting Notes – To be posted
- June 17, 2010 Meeting Notes – http://www.naesb.org/pdf4/smart_grid_ssd061710notes.doc
- July 1, 2010 Meeting Notes – To be posted
- July 13-14, 2010 Meeting Notes – To be posted
- July 22, 2010 Meeting Notes – To be posted
- August 5, 2010 Meeting Notes – http://www.naesb.org/pdf4/smart_grid_ssd080510notes.doc
- August 12, 2010 Meeting Notes – http://www.naesb.org/pdf4/smart_grid_ssd081210notes.doc
- August 26, 2010 Meeting Notes – http://www.naesb.org/pdf4/smart_grid_ssd082610notes.doc
- September 9, 2010 Meeting Notes – http://www.naesb.org/pdf4/smart_grid_ssd090910notes.doc
- September 16, 2010 Meeting Notes – http://www.naesb.org/pdf4/smart_grid_ssd091610notes.doc
- September 23, 2010 Meeting Notes – To be posted